

**Information Systems Development Support (ISDS) Contract
Contract Work Order (CWO) Implementation Plan**

for

**CWO 13 - Goldstone Solar System Radar Data Acquisition System
Design and Integration**

Developed by
The ISDS Team
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Under

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for the

California Institute of Technology
Jet Propulsion Laboratory
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Foreword

This is the top-level CWO document used for defining and controlling the effort, organizational structure, management authority and responsibility, and resource allocations for the CWO. This is the baseline CWO technical and management document developed under the guidelines set forth in DRD MA005 and in the ISDS Program Management Plan and supported by the ISDS methodology.

The **order of precedence** is the ISDS contract and attachments, then the ISDS Project Management Plan and its supporting procedures, and then this plan. The ISDS Project Management Plan and supporting procedures can be explicitly waived with the concurrence of JPL and ISDS Team management. Such actions and decisions are documented in Section 11, Deviations, Exceptions, and Waivers.

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1. Introduction

This is a system development task, already in progress, providing real-time acquisition for CW radar signals provided by GSSR hardware.

1.1 Background

The Goldstone Solar System Radar (GSSR) is a telecommunication facility that uses the Deep Space Network (DSN) antennas and receivers to generate images of planets and asteroids. Data products are generated from low resolution delay-Doppler radar imaging of over-spread targets by coherent processing of random hop frequency sequences. The CW Imaging System (CWIS) is a high-speed data acquisition, storage, processing and display computer. Baseband CW radar return signals from DSN receivers are digitized at up to 10 MHz. A high capacity disk drive stores data during real-time acquisition. An 8 mm tape drive stores archived data. Parallel processing elements receive acquired data and execute display algorithms. A high resolution color console displays algorithm results. The storage device stores data as bandwidth permits. On-line mass data storage is provided. Data archival and retrieval operates concurrently with real-time computation and display activity. Hardware and software interfaces are provided for data acquisition, mass storage and information display.

1.2 Purpose

The purpose of CWO 13 is to develop a real-time data acquisition system for the Goldstone Solar System Radar.

2. SOW & Deliverables

2.1 SOW

Description of Work

The contractor shall perform computer system design, implementation, testing and documentation to support the Communication Systems Research Section (331) and development of the Goldstone Solar System Radar (GSSR) Data Acquisition System (DAS).

Statement of Work Specifics

1. Design a real-time acquisition system for CW radar signals provided by the existing GSSR hardware. The system must be modular and expandable. It must be compatible with the existing GSSR hardware and operational interfaces. Complete baseline design by 30 Nov 94.

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2. Implement one CW system using procured hardware and application software. Install 8 mm tape storage for data archiving. Interface the system with the Ethernet LAN for offload of data products. Complete baseline implementation by 30 Dec 94.
3. Test and verify CW data acquisition in lab environment with simulated radar returns. Produce data products from acquired signals. Complete verification by 15 Jan 95.
4. Demonstrate CW system operation at Goldstone, CA, by 30 Jan 95.
5. Design a real-time graphical interface for the GSSR DAS system. It must function with the VxWorks operating system. It must be X-Window compatible. It must be remotely accessible. It must operate in real-time. Complete graphical interface design by 30 Feb 95.
6. Implement the graphical interface using procured hardware and application software. Provide real-time color displays of acquired and processed data. Provide X-Window mouse control and keyboard parameter entry. Complete baseline implementation by 30 Mar 95.
7. Demonstrate graphical interface operation by 30 Apr 95.
8. Design a two channel expansion for the baseline GSSR system. Configure second CW chassis to communicate with the primary unit for control and data transfer. Duplicate the storage and display functions of the first unit in the second unit. Complete two channel expansion design by 30 Jun 95.
9. Implement the expanded CW system using procured hardware and application software. Integrate system control into one user interface. Merge data streams as required for radar applications. Complete second system by 30 Jul 95.
10. Demonstrate expanded CW system operation at Goldstone, CA, by 30 Aug 95.
11. Design a network-based remote control interface for the GSSR system. Provide simultaneous local and remote control and display. Adjust remote display speed for network compatibility. Complete network interface design by 30 Sep 95.
12. Implement the network control interface using application software. Provide real-time control and display of GSSR data from any location using a standard telephone line and an X-terminal. Direct the X-Window display screens to the remote location. Complete remote network control and display by 30 Oct 95.
13. Demonstrate network-based remote control by 19 Nov 95.

2.2 Deliverables

2.2.1 CWO Specific Deliverables

See SOW above.

2.2.2 Deliverables Required by Contract or Derived from the CWO

See contract No. 960100 for specific data requirements of the CDRLs identified below.

1. MA005 - CWO Implementation Plan - draft, final, and updates as required

2. MA006 - Monthly Progress Report
3. MA007 - CWO Weekly Status and Major Problems Report

3. CWO Development / Implementation Approach

3.1 CI Development

The software is developed on the CWIS, a VME-bus based system configured with 28 TMS320C40 digital signal processors and two 68040 supervisory processors. An additional VME-bus graphics card provides an X-window interface and environment for the CWIS. The system uses VxWORKS a Unix-like operating system tailored for the real-time environment and also using the X-window interface for user display and entry.

3.2 Documentation

Documentation tasks consist of preparing new or modifying existing documentation using Word. The final versions are delivered to Section 331 in electronic format.

4. Management Approach

The management approach for this CWO is derived from and is consistent with the ISDS Program Management Plan. CWO specific items are limited to the WBS and the details of the CWO.

4.1 Subcontractors

4.1.1 Computer Sciences Corp. (CSC)

Infotec has retained CSC as its subcontractor for the ISDS contract. The terms and conditions of this subcontract are contained in Infotec's subcontractor agreement SK9503.

The ISDS Team which consists of Infotec and CSC operates as a virtual corporation with all direction and decisions residing with the Infotec PM. Technical direction of each CWO resides with the CWO manager regardless of company affiliation. CWO staffing is based on the best personnel able to meet the needs of the CWO without regard for company. JPL's interfaces with a single point of contact, the ISDS Team.

4.1.2 Affiliates/Consultants

Since this CWO is an extension of the effort under Telos CWO 52, Automated Information Services, Inc., (identified by JPL as key to effort) has been retained by the ISDS team as a consultant.

4.2 CWO Change Management

Change management for this CWO follows the process defined in the ISDS program Management Plan and in the Contract.

4.3 Tracking the Work

Schedules are given to all personnel working on the CWO. The schedule contains the individual's tasks and expected completion/milestone dates. In addition, all CWO personnel are given a Work Authorization Document (WAD) which contains valid time charge numbers correlated to the CWO tasks.

Weekly status reports are submitted by the CWO personnel to their CWO manager. These reports are used to update the CWO schedule contained in Microsoft Project and track CWO progress. CWO costs are collected and tracked in Microframe using CWO personnel timecard data and MIS data downloaded from corporate computers.

5. Risk Management Plan

Risks specific to this CWO are presented in the following two tables. The first, Table 5-1, enumerates the high level risks associated with this CWO and with most CWOs.. The second, Table 5-2, enumerates the critical risks, impact, and the technical and managerial mitigation strategies for this CWO.

Table 5-1 - High Level Risks for the CWO and How the ISDS Team Significantly Mitigates their impact on JPL

Type	Factor	CWO	Mitigation
known	Assumptions	Skill mix Technical Assumptions	Scope of CWO Scope of CWO
potential	Commitments	GFE availability and quality	Identify all, plan for it
	Technical / Management	Estimates & assumptions	Interface with JPL to identify ahead of time
		Interpretation of requirements	Interface with JPL to identify ahead of time
		Availability of key personnel	Skills are generally available in the job market
	Knowledge loss at CWO end	Inability to respond to problems or change requests	All work is documented and checked.
Unknown	--	Changing funding & priorities Changing requirements Key personnel attrition	All work is documented and checked. All work is documented and checked and necessary skills are generally available in the local job market

Table 5-2 CWO Requirements Risks, Impact, and Mitigation Strategies

Risk	Impact if Risk Realized	Mitigation
No critical risks identified	N/A	N/A

6. Work Breakdown Structure (WBS)

The CWO uses the standard ISDS WBS, modified to reflect the SOW.

CWO 13 ISDS Work Order Authorization

Name:	Automated Information Services (Consultant)	
Start Date:	12/28/94	End Date: 9/17/95
		Revision: 2

You are authorized to invoice these charge numbers from start of business on the start date through close of business on the end date.

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ISDS WBS Number	Description of Work
312	SOW item 1: Design a real-time acquisition system for CW radar signals provided by the existing GSSR hardware. The system must be modular and expandable. It must be compatible with the existing GSSR hardware and operational interfaces.
313	SOW item 2: Implement one CW system using procured hardware and application software. Install 8 mm tape storage for data archiving. Interface the system with the Ethernet LAN for offload of data products.
531	SOW item 3: Test and verify CW data acquisition in lab environment with simulated radar returns. Produce data products from acquired signals.
741	SOW item 4: Demonstrate CW system operation.
322	SOW item 5: Design a real-time graphical interface for the GSSR DAS system. It must function with the VxWorks operating system. It must be X-Window compatible. It must be remotely accessible. It must operate in real-time.
323	SOW item 6: Implement the graphical interface using procured hardware and application software. Provide real-time color displays of acquired and processed data. Provide X-Window mouse control and keyboard parameter entry.
742	SOW item 7: Demonstrate graphical interface operation
332	SOW item 8: Design a two channel expansion for the baseline GSSR system. Configure second CW chassis to communicate with the primary unit for control and data transfer. Duplicate the storage and display functions of the first unit in the second unit.
333	SOW item 9: Implement the expanded CW system using procured hardware and application software. Integrate system control into one user interface. Merge data streams as required for radar applications.
743	SOW item 10: Demonstrate expanded CW system operation.
342	SOW item 11: Design a network-based remote control interface for the GSSR system. Provide simultaneous local and remote control and display. Adjust remote display speed for network compatibility.
343	SOW item 12: Implement the network control interface using application software. Provide real-time control and display of GSSR data from any location using a standard telephone line and an X-terminal.

Direct the X-Window display screens to the remote location.

744 SOW item 13: Demonstrate network-bases remote control.

7. CWO Organization and Staffing

7.1 CWO Staff Names, Qualifications, & Availability

Since this CWO is an extension of the effort under Telos CWO 52, Automated Information Services, Inc., (identified by JPL as key to effort) has been retained by the ISDS team as a consultant and is available full time for the task duration.

7.2 CWO Organization

CWO task manager is Chad Nikoletich, who reports to the ISDS program manager, Kent Thomson.

7.2.1 CWO in the JPL Organization

This CWO supports Dr. Martin Slade of Section 331, Communication Systems Research.

7.3 Staffing Profile

This is an LOE task for one person for the specified period. It has a constant one (1) FTE staffing profile.

7.4 Estimation Approach

This effort had been estimated and scheduled prior to takeover by the ISDS team.

8. CWO Schedule and Dependencies

8.1 Schedule

See attached schedule for this effort.

8.2 Dependencies

Dependencies are those items outside the control of the CWO manager. They are identified below to facilitate planning and management. Critical dependencies, if any, are included in the Risk Management Plan. The dependencies on this CWO are:

Mission constraints: None

JPL facilities: Building 238-room 401, Goldstone availability.

JPL support: Technician support for CWIS hardware assembly.

User availability: None

Site personnel: Technician, Goldstone personnel availability.

GFE/GFI: none.

9. GFE/GFI Items

No GFE items for this CWO are under contractor/subcontractor control.

10. Close-out Plan

This section will be provided 30 days prior to CWO end.

11. Deviations, Waivers, & Exceptions

This CWO has no deviations to established standards and procedures.